Mixed-Feedstock Biodiesel Guidance
Low Carbon Fuel Standard

July 13, 2012

Introduction

This document provides producers of mixed-feedstock biodiesel with guidance on how to determine the carbon intensities of finished fuel volumes produced from feedstock mixtures. It was drafted for inclusion in the next version of the Low Carbon Fuel Standard Question and Answer Guidance Document[1]. Until that Document is revised, however, this document will reside on the Method 2 web site[2] where it will have the same status as the guidance currently appearing in the Question and Answer Guidance Document. It will, in other words, be available for use by biodiesel producers participating in the Low Carbon Fuel Standard.

Biodiesel can be produced from almost any plant oil, animal fat, used restaurant grease (yellow grease) or tallow. The conventional biodiesel production process converts the triglycerides in these oils and fats into chemicals called long-chain mono-alkyl-esters, which are referred to as fatty acid methyl esters (FAME). The conversion process is referred to as transesterification.

Transesterification involves reacting triglyceride oils with alcohol (usually methanol) in the presence of a catalyst in a simple closed reactor system at low temperature and pressure. In the transesterification reaction vessel, the mixture of alcohol and oils is allowed to settle for one to eight hours. The products of the transesterification reaction are methyl esters (crude biodiesel) and glycerin (a co-product). After transesterification, a majority of the alcohol is removed from the glycerin and recycled back into the system. The biodiesel from the process is purified and washed to remove residual catalyst and soaps. The glycerin from transesterification can be purified and sold to the pharmaceutical or cosmetic industries.[3]

Table 1 describes the five FAME biodiesel pathways currently available for use under the California Low Carbon Fuel Standard (LCFS):

[1] California Air Resources Board, June 10, 2011, Low Carbon Fuel Standard Question and Answer Guidance Document. Version 1.0. http://www.arb.ca.gov/fuels/lcfs/LCFS_Guidance_%28Final_v.1.0%29.pdf
[2] http://www.arb.ca.gov/fuels/lcfs/2a2b/2a-2b-apps.htm.
[3] California Air Resources Board, March 5, 2009. Staff Report: Initial Statement of Reasons, Proposed Regulation to Implement the Low Carbon Fuel Standard, Volume II. p. B-11. http://www.arb.ca.gov/regact/2009/lcfs09/lcfsisor2.pdf,

Table 1: FAME BD Pathways available under the LCFS

Feedstock	Pathway Code	Pathway Description	Carbon Intensity (gCO_2eq/MJ)
Soy Oil	BIOD001	Conversion of Midwest soybeans to biodiesel (fatty acid Methyl esters – FAME)	83.25
Used Cooking Oil	BIOD002	Conversion of waste oils (Used Cooking Oil) to biodiesel (fatty acid methyl esters – FAME) where “cooking” is required	15.84
	BIOD003	Conversion of waste oils (Used Cooking Oil) to biodiesel (fatty acid methyl esters – FAME) where “cooking” is not required	11.76
Used Cooking Oil	BIOD004**	Conversion of waste oils (Used Cooking Oil) to biodiesel (fatty acid methyl esters – FAME) where “cooking” is required. Fuel produced in the Midwest	18.72
	BIOD005**	Conversion of waste oils (used Cooking Oil) to biodiesel (fatty acid methyl esters – FAME) where “cooking” is not required. Fuel produced in the Midwest	13.83
Canola Oil	BIOD006	Conversion of North American Canola to biodiesel (fatty acid methyl esters – FAME)	62.99
Corn Oil	BIOD007**	Conversion of corn oil, extracted from distillers grains prior to the drying process, to biodiesel	4.00
Animal Fat	BIOD008	Conversion of mixed tallow to Biodiesel (FAME Process); Feedstock originates in and production occurs in the United States; Cooking required.	40.18
Tallow	BIOD009	Conversion of tallow to Biodiesel (FAME Process); Feedstock originates in and production occurs in California; Cooking required.	34.11

** The CI value for this fuel pathway was affected by regulatory amendments approved on February 21, 2012. Additional information is available here: http://www.arb.ca.gov/fuels/lcfs/reportingtool/sixmonthinterim.pdf

Producers are increasingly turning to feedstock blending as a means to reduce their dependence on sometimes unpredictable supplies of single feedstocks. The ability to purchase and run a variety of feedstocks across a wide range of blend proportions reduces the likelihood of production disruptions caused by shortages of individual feedstocks.

This pathway policy document describes how one category of multiple-feedstock biodiesel producers will calculate the fuel carbon intensities they report under the

Method 1 provisions of the LCFS regulation[4]. This policy applies only to producers whose production processes and accounting systems enable them to associate all volumes of biodiesel produced with specific individual feedstocks. Operators of most batch production systems and some continuous systems which incorporate advanced feedstock accounting systems will be able to use the methods described below to calculate their pathway carbon intensities. Operators of continuous systems in which accurate matching of feedstocks to specific finished fuel volumes is not possible may not use the procedures described herein to determine their carbon intensities.

Policy

The policy described in this document is based on existing LCFS guidance that administratively allows for procedures by which regulated parties can account for commingled ethanol products.[5] Under these procedures, ethanol at various CIs may be commingled in tanks, but the volumes at each CI must be separately accounted for over time, as fuel is withdrawn from and added to the tank.

In keeping with this LCFS administrative guidance, varying volumes of ethanol products at different CI values may be commingled in stationary and rail car tanks when the owners of these products account for the volumes available at each CI. Ethanol facilities that produce distillers' grains with solubles (DGS) at varying dryness levels can, for example, associate a portion of a production run with each DGS dryness level. Because DGS drying consumes energy, each dryness level is associated with a different carbon intensity (the drier the product, the higher the carbon intensity). Hence, a given production run can yield ethanol at two or more carbon intensities. The volume of ethanol at each carbon intensity level is proportional to the DGS produced at each dryness level.

This DGS-to-fuel proportionality is enforced at the volumetric rather than the molecular level. The production facility is not required to segregate and sell separately the specific ethanol volumes associated with each DGS dryness level. These volumes can be commingled in storage and transport tanks so long as the volumes of fuel at each carbon intensity are strictly accounted for. A storage tank may, for example, contain 70,000 gallons of ethanol with a carbon intensity of 95.66 and 30,000 gallons with a carbon intensity of 80.70. The owner of that ethanol may withdraw any of those gallons for sale at a carbon intensity of 80.70, so long as no more than 30,000 are withdrawn and sold. Once all 30,000 of those gallons are sold, all remaining gallons must be sold at the higher carbon intensity. No gallons may be sold prospectively. Volume deficits may not, in other words, be created and then erased by the subsequent addition of new volumes to the tank.

[4] Section 95486(b)(2)(B) of the LCFS Regulation (Title 17, CCR) specifies that Method 1 is to be used as follows: ". . . for each of a regulated party's fuels, the regulated party must use the carbon intensity value in Lookup Table that most closely corresponds to the production process used to produce the regulated party's fuel."

[5] California Air Resources Board, June 10, 2011, Low Carbon Fuel Standard Question and Answer Guidance Document. Version 1.0. Section IX, "Commingling of Products," p. 26 http://www.arb.ca.gov/fuels/lcfs/LCFS_Guidance_%28Final_v.1.0%29.pdf

This same commingled products accounting method will be used to determine the CIs of mixed feedstock biodiesel. Producers and regulated parties should use this approach to calculate the volumes of biodiesel associated with each feedstock present in the finished fuel storage tank at any given time. Producers should be able to produce records that unequivocally associate specific quantities of feedstock purchased with specific volumes of fuel produced. As volumes are added to and withdrawn from the tank, the volume at each feedstock-related CI will be adjusted to account for those additions and withdrawals. Commingled product CI accounts for mixed-feedstock biodiesel are to be maintained in real time. Averaging over extended accounting periods (such as a month or a calendar quarter) is not permitted.

Shipments of mixed feedstock biodiesel to California must reflect the CIs associated with each feedstock and the proportions of each CI shipped must reflect the overall feedstock proportions. In other words, producers cannot apply their feedstock proportions to the entire run of fuel and then sell only the low-CI portions to California (while selling the high-CI portions elsewhere). The gallons that come into California must reflect the proportions of all feedstocks used to produce the batch of fuel from which the California shipment originated.

Application of Feedstock Proportions to Finished Fuel

Because biodiesel yields vary somewhat from feedstock to feedstock, CIs should be allocated to finished fuel volumes based on yield. Biodiesel yields also vary, however, from producer to producer. The variation across producers may be equal to or greater than the variation across feedstocks. The application of feedstock CIs to finished fuel volumes under this policy will therefore be accomplished using the standard mass yield ratio of 1:1. In general, a pound of feedstock (in the form of rendered oil) produces a pound of finished biodiesel. This standard yield will be used in the case of mixed-feedstock biodiesel only because actual biodiesel yields are known to be variable. A standard yield should not be used in cases in which actual yields are known and are relatively invariant across producers.

The use of a 1:1 mass yield ratio results in a very straightforward allocation of feedstock CIs to finished fuel volumes: rendered oil mass equals finished fuel mass. If the feedstock mixture contains 800 pounds of soy oil, for example, the resulting volume of biodiesel will contain 800 pounds of fuel at the soy oil biodiesel CI of 83.25. Table 2 illustrates the direct application of feedstock CIs to finished fuel mass based on rendered fuel mass.

Table 2: An Example of Applying Mixed Rendered Feedstock CIs to Finished Biodiesel Volumes

Rendered Feedstock	Feedstock and Finished Fuel (lbs)[a]	Fuel CI
Soy Oil	800	83.25
Corn Oil	500	4.00
Used Cooking Oil – high energy rendering	700	18.72
Total	2000	N/A

[a]The ratio of finished fuel to feedstock mass is close to 1:1

LCFS Fuel Producer Registration for Mixed Feedstock Biodiesel Facilities

To aid in the implementation of this policy, the mixed-feedstock biodiesel producer may register under the LCFS Biofuel Producer Registration program. Producers should register for each feedstock that will be used to produce mixed-feedstock biodiesel ("feedstock" and "pathway" are used synonymously here, since biodiesel pathways are, as Table 1 shows, differentiated by feedstock). Information on registration procedures can be found on the LCFS website at:

http://www.arb.ca.gov/fuels/lcfs/reportingtool/biofuelregistration.htm